

3M™ Nextel™ Ceramic Tape Proves Superior Under Heat

Without the use of 3M™ Nextel™ ceramic fiber tape, MW Kellogg could not have developed a new type of gasification technology – the circulating-bed transport reactor.

By using 3M Nextel ceramic fiber tape to insulate high temperature process tapes, fiber tape to insulate high temperature process tubes, the company can now offer refineries a cleaner type of gas production that creates less pollution and hazardous waste than earlier technologies.

Founded in the early 1900s and headquartered in Houston, Texas, MW Kellogg Technology Company focuses on the design and license of technology for the construction of petrochemical complexes. Its Houston facilities house complete pilot plant capabilities; the company can build pilot programs as well as do testing for other companies.

In its effort to improve gasification technology, MW Kellogg developed the circulating-bed transport reactor, according to Chris Taylor, MW Kellogg's Supervisor of Operations Services. Unlike conventional technology that uses a horizontal, fluidized bed for feed stock, the circulating-bed reactor uses a 55-foot tall, oval loop of 2-inch pipe for the gasification process. The pipe, which grows to an 18-inch diameter once insulated, is heated from room temperature to 2000°F by means of a beaded resistance wire. The wire is wrapped over the pipe which, in turn, is electrically insulated by a ceramic cloth tape. (See Figure 1.)

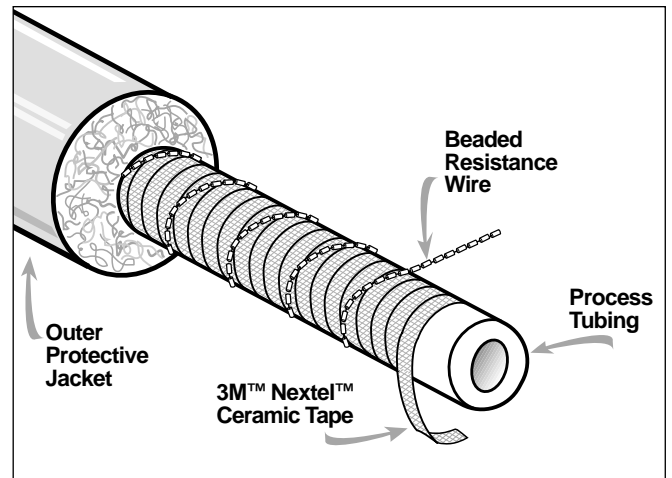


Figure 1: Schematic drawing showing construction of resistance-heated process pipe. The ceramic cloth tape prevents an electrical short from occurring between resistance wire and the pipe.

While the new technology promised improved operating efficiency and a more environmentally friendly process, there was a problem: developers needed to find a reliable ceramic insulating material that could maintain its strength and flexibility during prolonged exposures to temperatures in excess of 2000°F.

“... 3M™ Nextel™ tape retained 100% of its integrity. In fact, when we took it apart, it looked the same as when we put it together. The bottom line is that Nextel showed itself to be far superior.”

Initial tests of the process were unsuccessful because the chosen ceramic insulating cloth tape failed. “When we examined the pipe after our first test, we found that the combination of

the expanding pipe and shrinking tape caused the tape to tear apart,” Taylor said. “We knew we needed something better.”

In the first test, developers used a leached-silica ceramic cloth. This material is made by taking a glass fiber and leaching out the non-silica constituents; what remains is a pure silica that can be woven into a flexible tape. But the Achilles heel of this product is its manufacturing process; because the leaching process removes nearly 50% of the original glass fiber, what is left is a porous solid. When subjected to high temperatures, the vacancies created by the leaching process cause the tape to shrink. At the same time, the intense heat expands the pipe. The result: tape failure.



3M™ Nextel™ Ceramic Fibers and fabrics for high temperature applications are available in fabrics, sleeveings, tapes, non-wovens and threads.

After the initial failure, Taylor and the project group decided to study the process. They set up a test with a 12-foot section of pipe. Half of the pipe was insulated with the first product, the other half with the 3M Nextel Ceramic Fiber tape. Nextel is a sol-gel derived, fine-grained fiber made from alumina, silica, and boria. Even after prolonged exposure at elevated temperatures, these fibers retain their size and flexibility.

Over a period of three weeks the group heated the pipe repeatedly to 2150°F. After the test period, the pipe was examined for performance. Taylor said, “The first ceramic tape failed again, but the Nextel tape had retained 100% of its integrity. In fact, when we took it apart, it looked the same as when we put it together. The bottom line is that Nextel showed itself to be far superior.”

Initially, Taylor bought the first ceramic tape product because it cost less. “The first tape was said to be equivalent to the 3M product but less expensive, so we bought it,” Taylor said. “It wasn’t equivalent at all. The failure of that tape ended up costing about \$65,000.” “[using] the 3M ceramic tape to build the working reactor, we haven’t had a failure yet, after more than a year of service.”

As a result of the successful development of this new technology, MW Kellogg is able to offer the petrochemical industry a state-of-the-art gasification process that provides improved economics and fewer by-products.

As for the lessons learned from the project? Says Taylor: “Nextel is superior to any ceramic tape I’m familiar with. It will be the tape of choice anytime I run into a project involving high temperatures.”

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